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ABSTRACT

Information about the relationship between water and health is provided in this module. Topics considered include: (1) the various uses of water; (2) water demand of individuals in certain communities; (3) water sources; (4) water cycle; (5) pure water; (6) water pollution, focusing on pollution resulting from heat, chemicals, radioactive materials, oils (and suspended solids and colloids), and pathogenic organisms (bacteria, viruses, fungi, protozoa, and helminths); (7) water as a factor for the spread of diseases; (8) water-related diseases; and (9) water treatment. Included in appendices are tables with data on selected characteristics of dwelling units and households, water-related diseases (their entry and exit in man), modes by which certain water-borne diseases are spread, number of cases and death by leading diseases, highest number of cases for several diseases in various regions; and morbidity causes and mortality causes. Also included are suggested individual and group activities related to information in the appendices. (JN)

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What We Take From Our Environment

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Science and Technology Education in Philippine Society

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Water and Health

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WATER AND HEALTH

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Water and Health

Water is the most abundant compound we encounter in our daily life. No other compound plays a more important part in our daily lives than water.

Can you think of things that are dependent on water?

Countless things, don't you agree?

. . . the growth of plants (Fig. 1a, b)

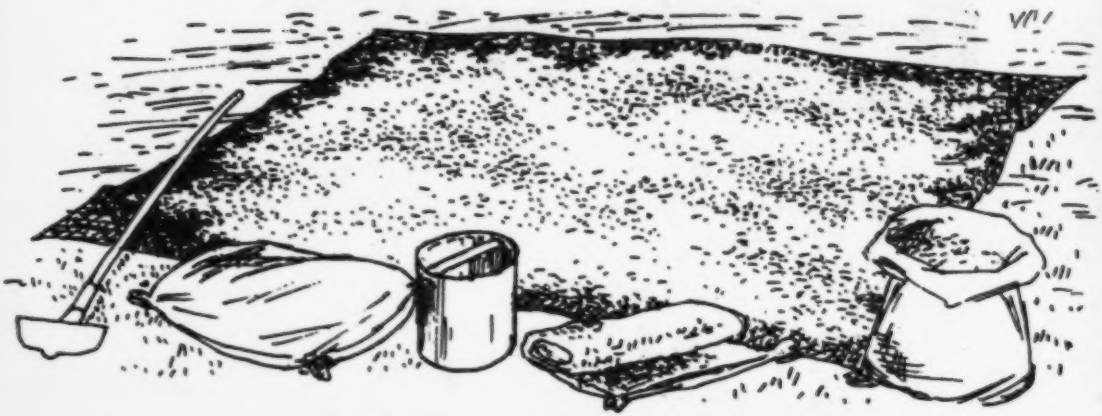
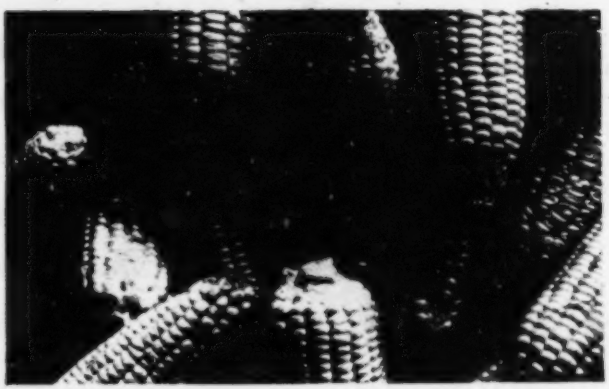


Figure 1. (a) To produce 1 kilogram of dry rice about 6 000 kgs of water are needed.

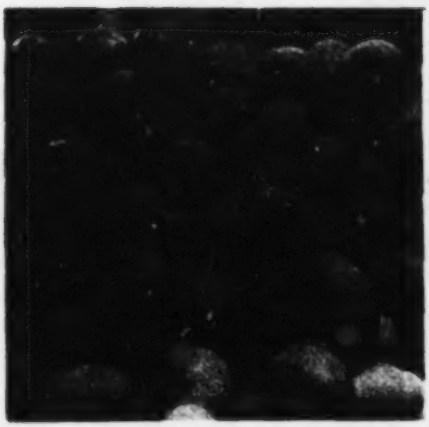


(b) It takes about 365 kilograms of water to produce 1 kilogram of dry matter in corn.

. . . the raising of animals to obtain meat, milk or eggs (Fig. 2a, b, c, d)

Figure 2. (a) Beef is 77% water. To produce a kilogram of beef a cow must drink many times that much water.

(b) Fish are 80% water. They do not only consume water but must have large volumes of water in which to live.



(c) Milk is 88% water. To produce 1 liter of milk a cow requires about from 4 to 6 liters of water.

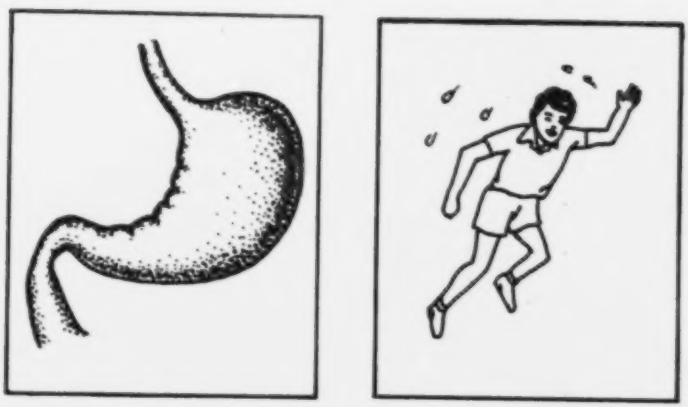
(d) Eggs are 66% water. To produce a dozen eggs, hens require about 6 liters of water.

. . . keeping our bodies healthy and clean (Fig. 3)

a) Our body is two-thirds water.

b) Life and health depend on the water taken into the body each day.

c) Cleanliness made possible by use of water guards your body from disease.



d) Water is the medium by which load is carried in the body and by which wastes are removed.

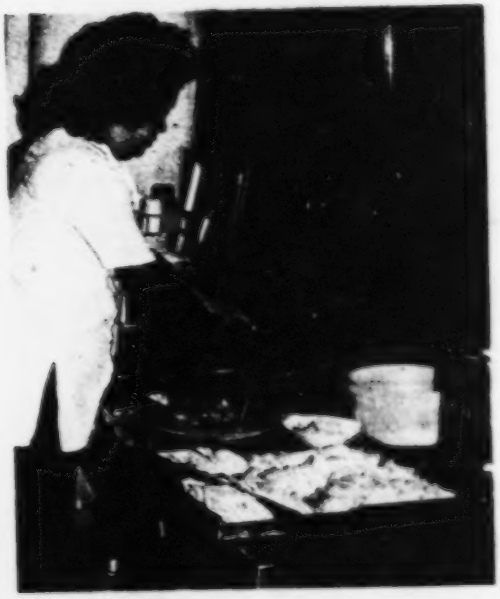
e) Water cools the body by evaporation from the sweat glands.

Figure 3. Water and the individual

. . . keeping our homes and things clean (Fig. 4a, b, c)

Figure 4. (a) Laundering

(b) Washing utensils



. . . preparation and cooking of food

(c) Food preparation

. . . Water has a tremendous effect on . . .

. . . climate and in shaping the earth's surface.

Figure 5

. . . the industrial need for water is also great.

Figure 6. Our rivers, lakes, and oceans provide cheap means of transportation.

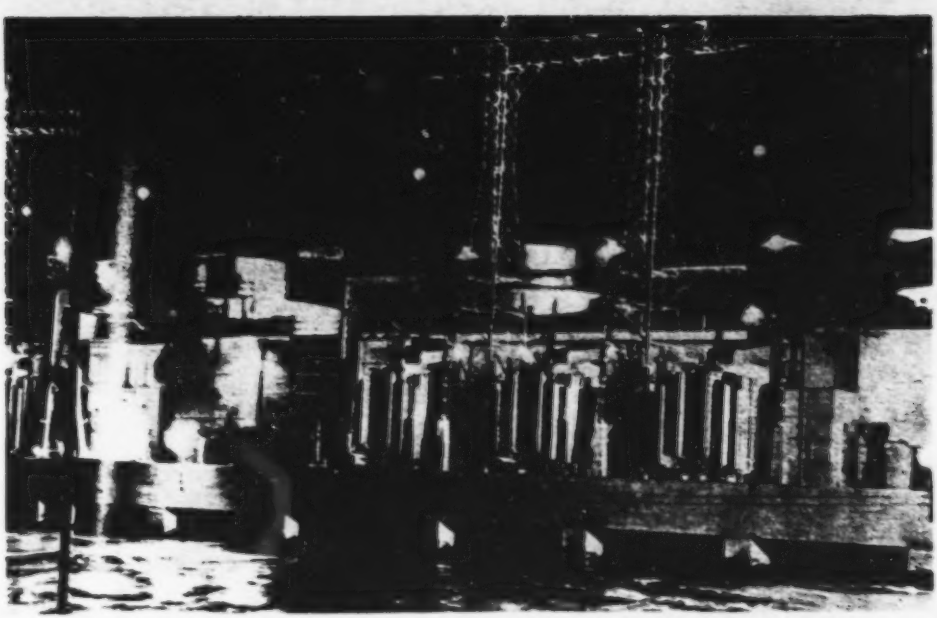


Figure 7. Water is used for generating electric power.

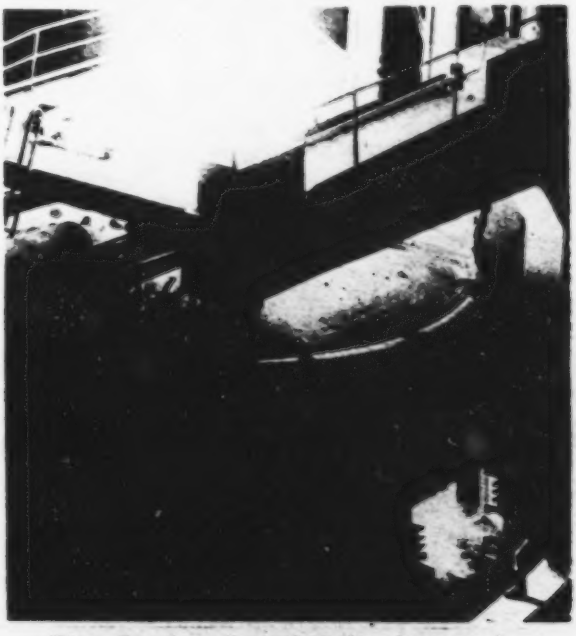


Figure 8. A steel manufacturing plant uses about 42 138 000 kg of water in the process.

. . . Water plays an important part in the nation's recreational activities

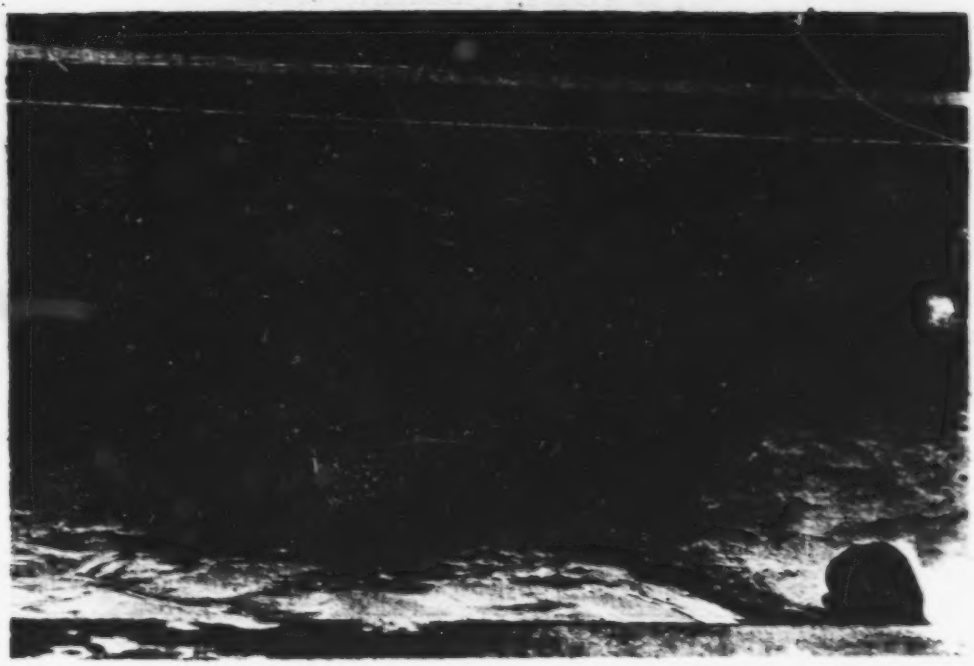


Figure 9

. . . and in many other ways.

Water is a major constituent of all living things and it also plays a major role in all their processes.

Can you imagine how it is going to be with little water? or total lack of it?

In our homes whether in the city or towns or barrios water is essential for cleanliness and health. The average Filipino family uses plenty of water per day, per year for various household purposes.

Let us examine Table 1 showing a hypothetical data on the water demand of each person in certain communities.

Table 1. **Water Demand Per Person Per Day (in liters)**

Community No. (Population)	1 (3 000)	2 (2 000)	3 (1 000)	4 (500)	5 (300)
Maximum daily consumption (LPD)*	20-35	45-65	95-130	150-190	180-120
Average daily consumption (LPD)*	10-20	30-45	65-100	120-160	140-180
Estimate community consumption					

*LPD – liters per day

Make a list of activities done in the home that would use water. Approximate the volume of water used per day. Tabulate your answers.

Worksheet 1. **Approximate Volume of Water Used in Certain Activities**

Activities	Approximate Volume of Water Used (in liters)
bathing brushing teeth waste disposal laundering food preparation cooking _____ _____ _____ (others specify)	

Do you think the data shown are very good estimations of the maximum and average daily consumption of water per person per day? Why? or why not?

Table 1 shows that water demand does not only differ for each person but it also differs from community to community.

What do you think are the possible reasons for such differences? Would practices, customs, and beliefs, have something to do with it? Cite specific instances. Do you think the time of the day, or month of the year would affect the amount of water consumed? Why? At what time of day would water consumption be more? be less? At what time of year would water consumption be more? be less?

There are a lot of things/activities, therefore, that affect the amount of water used by people.

Just how much water is needed by a community? Can you make an estimate based on Table 1? What will you do?

If you take the maximum daily consumption (MDC) or the average daily consumption (ADC) of a community and multiply it with its population, you would be able to get an estimate of the community consumption (ECC).

[ECC = MDC X population, or ECC = ADC X population]

For instance in community 1, the estimated water consumption of the community is about 60 000 LPD if you take 20 and multiply it by its population which is 3 000).

What about the other communities? Put your answers on the appropriate space in Table 1.

Reason will tell us that increase in the number of people will mean an increase in water consumption.

How would you then explain the result that some communities with fewer people use greater amount of water?

As you examine the tables again, you will realize that there is a greater demand for water for domestic activities. If we come to think about the water needs of agriculture and industry, the volume will even be much greater. Our use of water is increasing rapidly with our growing population. Already there are acute shortages of water in many localities. Careless pollution and contamination of our streams, lakes and underground sources has greatly destroyed the quality of water which we have available.

SOURCES OF WATER FOR DOMESTIC USE

There are several sources of water for our daily use:

1. rainwater collected from roofs of buildings or special water sheds and stored;
2. natural surface water, in streams and lakes;
3. ground water.

Groundwater is the principal source of water in most rural areas. Natural surface waters from streams, lakes, and ponds are used extensively for irrigation, for industry, for city water supplies or for domestic purposes.

THE WATER CYCLE

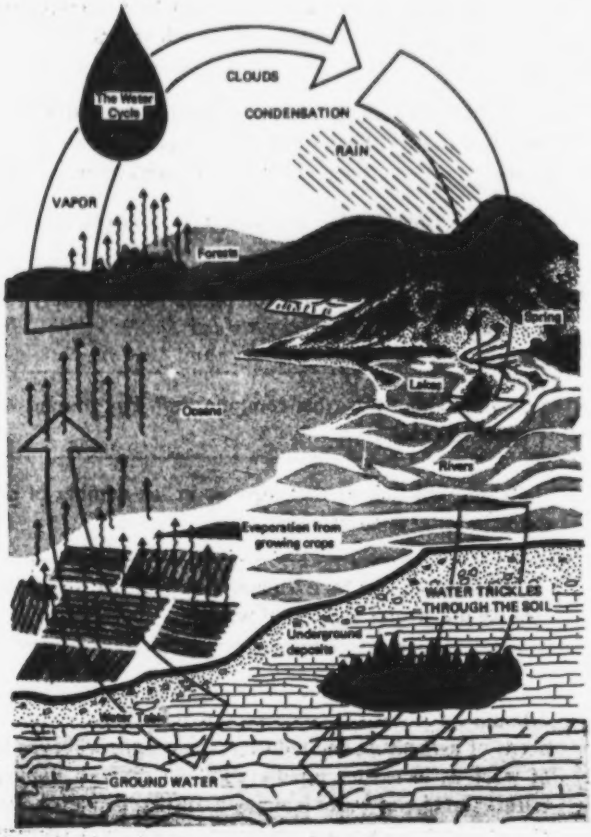


Figure 10

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Water in the biosphere moves in a cycle. This cycle involves 3 phases: precipitation, run-off and evaporation. Although large bodies of stored water are clearly seen as seas, rivers, lakes, snow and others, rain which is not often thought of in the same way is the primary source of water. Upon reaching the earth's surface, many things happen to rain: it may immediately evaporate, it may soak into the earth and form the underground water, it may become surface waters like ponds or lakes, or it may run-off to enter streams and rivers. Both underground and surface waters end up eventually into the oceans. During transport and while in storage, water is continually being evaporated and reenters the atmosphere, from which it will again be precipitated (Fig. 10).

Fig. 10 shows a simplified description of the water cycle. If you carefully examine the diagram of the water cycle, water that is "lost" from the ground goes to air, and water that is "lost" from the air goes to the ground. Which means no water is lost at all! *

How come people speak about scarcity of water supply? Why do people suffer from lack of water supply?

While the water cycle brings about the continuous supply of water on the earth's surface it does not assure us that the water would fall and be in the places where it is needed or that water would be of a quality that is required.

What is the acceptable quality of water that is needed?

"PURE WATER"

What is pure water?

Usually this refers to water that is fit to drink and not to water as a pure substance like distilled water. In fact, we are so used to drinking water containing some solutes that pure water or distilled water would be unpleasantly "flat" and be considered unfit for drinking.

Pure water does not exist in nature. Being a good solvent, substances readily dissolve in it. Microorganisms and other solid particles may be suspended in it. These things that are either dissolved or suspended in water affect the water quality.

Water that is good for one use may not be acceptable for another. Water that is not fit for man to drink may be quite all right for animals. Water that is

*The amount of water remains constant. The amount of water will be no less in the future than it is now.

too contaminated to support aquatic life may be acceptable for cooling, as in a power plant. Water that contains too many dissolved salts may not be fit for drinking but it may be quite useful for watering plants.

What other examples can you cite that would show how one kind of water may be unfit for one use but may be quite acceptable for another?

HOW DOES WATER GET CONTAMINATED?

Look again at the diagram for the water cycle (Fig. 10).

Does it show you how natural water becomes contaminated? In which phase(s) of the water cycle would contamination take place?

During precipitation, rainwater will absorb naturally occurring gases and some gases released by industries. When it reaches the earth's surface it becomes exposed to many other materials, some of which may be harmful. Run-off and storage water collect many kinds of materials present on the ground, much of which is in the form of waste from industrial, agricultural or household activities.

WHAT ARE THE KINDS OF POLLUTANTS THAT MAY BE FOUND IN OUR WATER SUPPLIES?

As has been cited previously, the quality of water that is acceptable will depend on its use. Therefore, our definition of polluted water depends on what we want to use it for. We might then define a **pollutant** as any substance or a factor that prevents the use of water for some particular purpose.

We may classify them according to their effects:

1. **HEAT**

   The machines of power plants and factories use water for cooling. The cooling water may be warmed so much, and when it is returned to its source, the rivers or streams, it often causes considerable changes in the aquatic life. The addition of excess heat giving rise to these disturbances is called **thermal pollution.** The known effects are:

   a. There is a decrease in the amount of dissolved oxygen. Under this condition organisms, like fishes, may suffocate and die.
   b. There is an increase in the chemical and biological activities of the organisms resulting to undesirable changes in the biological patterns of the organisms. For example, spawning, fertilization, and hatching of fish

eggs; when these processes are speeded up, the food required by the newly hatched young may not be present; this food shortage will endanger the whole fish population.

c. There might be drastic changes in the biochemical reactions especially if the temperature is high resulting in immediate death.

2. CHEMICALS

2.1 Organic Compounds

Almost all organic (carbon and hydrogen-containing) compounds in water serve as food for bacteria. When it is added to water, the concentration of dissolved oxygen is reduced by the action of bacteria to a level where fish, algae and other organisms cannot live. When they die they add to the organic matter requiring oxygen for its decomposition.

Organic pollutants are present in human and animal wastes, liquid waste from food canneries, meat packing factories, slaughterhouses, paper mills, chemical industries, and tanneries.

2.2 Synthetic Organic Chemicals

They may be found in fuels, plastics, fibers for cloth, solvents, detergents, paints, inks, dyes, insecticides, herbicides, fungicides, food and beverage additives, drugs and pharmaceuticals. These may reach bodies of water. Many of these synthetics cannot be broken down by bacteria or other organisms in water (**non-biodegradable**) and so they would accumulate. Some of them which may be poisonous like DDT may be taken in by organisms that live in water. The small organisms are eaten by bigger ones and so on in a food chain, a food-web relationship, finally reaching man. Since these substances are non-biodegradable, they accumulate into larger and larger amounts as they enter the body of bigger organisms including man. A greater quantity reaches man – affecting his health in general as these materials enter the cells, tissues, and organs of the body.

2.3 Inorganic Compounds

2.3.1 *Nitrogen and phosphorous* when found in higher concentrations than normal will make algae grow rapidly resulting in what we commonly term as **algal bloom.** When the algae die and decay the amount of oxygen they use up is great causing the decrease of the oxygen contained in water. This can be harmful to fish and other aquatic organisms. Algal blooms usually result in the dirty appearance of a pond or lake, unpleasant odors and taste of water.

They may also result in the excessive growth of water plants, like water lilies, clogging the waterways.

These substances may come from domestic sewage (phosphates from household detergents), industries, or the run-off of fertilizers used for agriculture.

2.3.2 *Acids*

Liquid waste from industries, as well as mine tailings may carry with it large amounts of acids. When they find their way into the groundwater or streams and lakes they cause destruction of higher plants (only some bacteria and algae survive), and many microorganisms.

2.3.3 *Mercury*

The sources of this highly poisonous substance are many:

1. the manufacture of electrical apparatus, e.g. mercury vapor lights, mercury switches for electric circuits, mercury batteries;
2. manufacture of compounds to prevent fungi and mildew from growing on seeds, and paints especially formulated for use on ships and other structures exposed to water;
3. manufacture of pharmaceuticals, disinfectants used in the home, and
4. burning of coal.

Mercury compounds dissolved in water are passed on through microorganisms to fish, where they are concentrated. Eating fish containing large amount of this substance can kill people. The Minamata deaths in Japan were caused in this way. People died or were seriously affected by eating fish from the Minamata Bay (in Japan), which is highly polluted by mercury compounds. The damaging action of mercury in the body is not well understood but it has been proven that the damage done to living organisms is permanent; it cannot be undone.

2.3.4 *Lead*

Lead is released into the atmosphere by motor vehicles, by lead smelters, by brass manufacturing and casting, and by other processes involving the use of lead. Lead is then washed from the atmosphere onto the ground and into our lakes and streams.

Lead is also poisonous just like mercury. If found in drinking water, it is absorbed by the digestive tract and its presence in the body interferes with the production of hemoglobin.

3. RADIOACTIVE POLLUTANTS

These might come from mine tailings or from ore-processing mills or leakage from a nuclear reactor or its waste or radioactive fallout. The tailings may

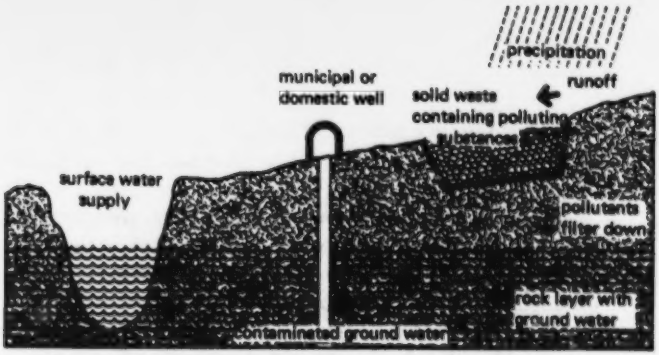

Figure 11. The water supply may be contaminated by chemicals seeping through the rock layers.

Source: Rodriguez, Violeta L. Philippine Environment Series. Water Resources, Surface Water/Project Leader: Leticia Cortés. Quezon City: SEC, UP, March 1980.

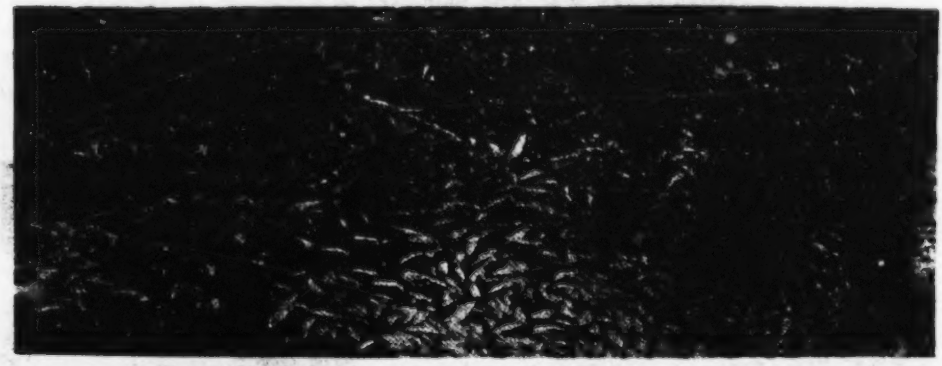

Figure 12. Effects of poisonous chemicals on fishes.

Figure 13. Water supply polluted by human waste.

Source: Rodriguez, Violeta L. Philippine Environment Series. Water Resources, Surface Water/Project Leader: Leticia P. Cortés. Quezon City: SEC, U.P., March 1980.

contain radioactive substances like thorium ($^{230}_{90}$Th), radium ($^{226}_{88}$Ra). From a nuclear reactor waste may contain strontium ($^{89}_{38}$Sr or $^{90}_{38}$Sr), barium ($^{140}_{56}$Ba), cesium ($^{137}_{55}$Cs), and iodine ($^{131}_{53}$I).

Thorium, radium, strontium and barium are chemically similar to calcium and tend to replace calcium in calcium phosphate, $(Ca_3(PO_4)_2)$, in the bones and be deposited there and their radioactivity may interfere with the production of red blood cells in the bone marrow.

Cesium is chemically similar to sodium and potassium, which are widely distributed in the blood and muscle tissues. When radioactive cesium soon finds its way all over the body it disrupts many vital body functions. Radioactive iodine ($^{131}_{53}$I) makes its way to the thyroid gland where it interferes with the function of that important organ.

Radiation from radioactive substances damages living tissues so that authorities rule that these substances be stored for 20 half-lives. In this length of time, radioactivity will have been reduced to about one-millionth of its original intensity and hence, safe for exposure to organisms. This rule requires that radioactive elements like strontium ($^{90}_{38}$Sr) and cesium ($^{137}_{55}$Cs) be kept isolated for about 600 years!

Figure 14. Nuclear explosion results in radioactive fall-out.

Can you imagine the danger posed by radioactive materials from nuclear reactors? atomic or nuclear explosion? unchecked wastes from mines?

4. **OIL, SUSPENDED SOLIDS, AND COLLOIDS**
   Oil prevents the exchange of O_2 and CO_2 between the air and water. This affects the respiration of aquatic organisms.

   The presence of solids that remain suspended cuts down on the amount of light that penetrates the water to be used in photosynthesis and this destroys the biological balance of aquatic life. These also result in the decrease of dissolved oxygen, and cloudy water which prevents fish from finding their food, making the water undesirable for domestic use.

5. **AGENTS THAT CAUSE DISEASES: BACTERIA, FUNGI, PROTOZOA, VIRUSES, HELMINTHS**
   These are the pollutants which are of special interest in this module. In the Philippines like other developing countries, fecal waste (human and animal) is perhaps the most common type of water pollutant. Such wastes often contain disease-causing organisms.

These descriptions of the pollutants and their sources give us an idea of the dangers our water sources are exposed to and its potential to do harm to the health of man.

Summarize what you have read on the pollutants of water. Use Worksheet 2 below.

Worksheet 2: **Water Pollutants**

Pollutant	Source(s)	Effect on man and environment

WATER AS A FACTOR FOR THE SPREAD OF DISEASES

Surface waters in streams and freshwater lakes are well-known possible carriers of diseases. Of all diseases affecting populations, those that are water-related are the cause for concern. Once contaminated, a water source can infect all users of water from that supply. Then the disease may be widespread in a short time; an epidemic results.

The more familiar pathogens in water include the bacteria causing typhoid fever, the cholera bacteria, and viruses causing infections of the liver and other internal organs.

The first proof that water is a carrier of disease was established in 1854 when an outbreak of cholera in London was traced to the drinking water common to the patients.

In addition to the transmission of disease by contaminated water, water plays a vital role in hygiene and sanitation. Diseases can spread as a result of conditions brought about by lack of water and poor personal hygiene. Dysentery and other diarrheal disorders are related to cleanliness. In the case of trachoma, a child who rubs his itchy eye with a finger that is dirty does not realize that he may be pushing trachoma virus into his eye. But given the opportunity and encouragement to wash his hands, this might never happen. Cleanliness will also prevent the spread of external parasites such as lice and mites, parasitic worms like pinworms and ascaris and fungi responsible for skin diseases. Use and reuse of common dining utensils without adequate cleaning is another route of the transmission of diseases.

In all these, sufficient clean water is needed to maintain hygienic conditions. Without adequate safe water supply many communicable diseases will spread. Changes in water supply may affect different groups of diseases in different ways: one group may depend on the changes in water quality; another on water's availability; and another on indirect effects of standing water. In short, **water quality, water availability** and **presence of standing water** affect the occurrence of diseases.

In what ways do these factors contribute to the occurrence of diseases?

Before attempting to answer this, read through the next section.

WATER-RELATED DISEASE

Below are 5 groups of water-related diseases:*

I. **Water-borne Diseases.** The infecting agents like those of dysentery and diarrhea, use water as a passive vehicle. These diseases also depend on poor sanitation.

*Specific diseases under each group is given on Appendix 2.

II. **Waterwashed Diseases.** Diseases spread as a result of conditions due to lack of water and poor personal hygiene. The intestinal infections in this group also depend on lack of proper human waste disposal. ex. – ascaris, scabies

III. **Waterbased Diseases.** A necessary part of the life cycle of the infecting agent takes place in an aquatic animal affected by waste disposal. ex. – schistosomiasis or snail fever.

IV. **Diseases with Water-Related Insect Vectors.** Infections are spread by insects that breed in water or live near it. ex. – malaria.

V. **Diseases Related to Fecal Disposal.** These are acquired through eating uncooked or improperly cooked meat, fish or other large aquatic organisms in water contaminated by fecal wastes. ex. – tapeworm infection.

To answer the question about the effect of some water factors on the spread of the disease, *copy Worksheet 3*. Fill in the answers on the appropriate spaces.

Do the groupings give you an idea of the likely effects upon the health of man of certain changes in water supply and fecal disposal practices? What possible suggestions can you make to improve health conditions?

Worksheet 3. Water-Related Factors and Their Effects on the Occurrence of Diseases

Factor	Description	Effect on Occurence of Disease	Reason(s)	Type of Diseases Affected
Water quality	contaminated with pathogens or toxic materials			
	not contaminated with pathogens or toxic materials			
Water availability	sufficient amount			
	scarce or none at all			
Standing water	presence of standing water			
	absence of standing water			

WATER TREATMENT

When used for domestic purposes, surface waters usually must undergo treatment to make them suitable for human consumption.

Water purification systems have been designed primarily to make water microbiologically safe for human consumption and likewise making the physical characteristics – color, odor, taste, turbidity at acceptable levels.

The kind and degree of treatment that must be applied to a body of water to make it safe depends to a great extent on the source. A body of freshwater, well water, water from reservoirs, water from lakes vary considerably in terms of pollutant composition.

Water treatment consists primarily of three processes: **sedimentation, filtration**, and **chlorination**. Water is first pumped from the source to large sedimentation basins. All basins are designed to hold large quantities of water for several hours to allow large particles of sand, rocks and other debris to settle out.

As part of the **sedimentation process**, certain chemicals like aluminum, calcium, iron are added to force insoluble substances to coagulate and settle. Many of the materials that make water turbid – the colloidal forms, are removed from the addition of these chemicals. The actual time required for completion of the sedimentation process varies.

The second process is **filtration**. Water is filtered through carefully constructed sand filters (various layers and size gradients in a depth of about 120 cm). In slow sand filtration fine quartz sand is usually used. This process is highly efficient and critical. This is where removal or trapping of microorganisms as protozoans and bacteria is done.

The final process is **chlorination**. Although most of the bacteria are removed during filtration, chlorine is added to destroy any remaining bacterial pathogens. The actual amount of chlorine added vary with the characteristics of the water processed. Water with high organic content have high chlorine demands. So water-quality criteria specify that drinking water should contain a residual chlorine concentration of 0.2 parts per million to maintain its bacterial killing power.

Figure 15 shows the Treatment Flow Diagram followed in Metropolitan Manila, by its agency the Metropolitan Waterworks and Sewerage System (MWSS).

Fluoridation has also been incorporated by MWSS to help prevent tooth decay.

It is known that fluoride content of drinking water has an influence on the development of teeth. The optimum level of fluoride for drinking is about 1 part fluoride per million parts of water. This is sufficient enough to retard tooth decay but not enough to cause fluorosis or mottled enamel. Fluorosis develops when too much fluoride is present.

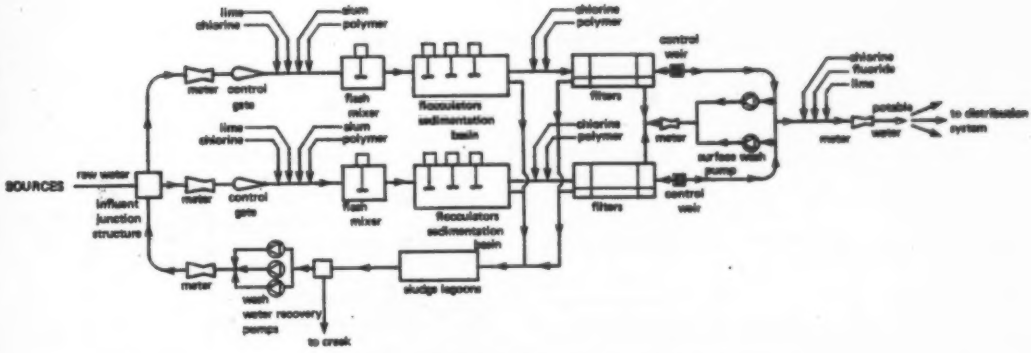

Figure 15. Treatment Process Flow Diagram

After chlorination and fluoridation water is pumped to storage tanks from which it flows by gravity to the consumers.

To guarantee that water is safe for drinking, samples from various outlets are analyzed periodically by standard microbiological tests like the coliform test. This test is designed to detect kinds of bacteria that live in the large intestine. These coliform organisms are not present in natural waters in large numbers unless the waters are polluted by feces. Its presence therefore indicates fecal pollution of the water and it might contain pathogenic forms. Its absence indicate that fecal material is not present in water and pathogens are **probably** absent. This does not rule out the presence of other pathogens like viruses and other parasites which are not of fecal origin. Thus the number of coliforms present in water serves as an indicator of water quality.

How is water treated so that it is made safe for drinking? What substances, if any, are put in water? What are their respective roles?

Why can't one be sure that pathogens are absent when fecal contamination is not detected? Give specific examples.

In case where no sanitary water supply is available, the following procedures may be done to treat the water and render it safe for drinking. See Fig. 16.

Having gone through the other sections of this module, you would realize that our water problem is two-fold:

1. How can we get the quality of water we need?
2. How can we supply water in areas where it is scarce?

HOUSEHOLD TREATMENT OF WATER

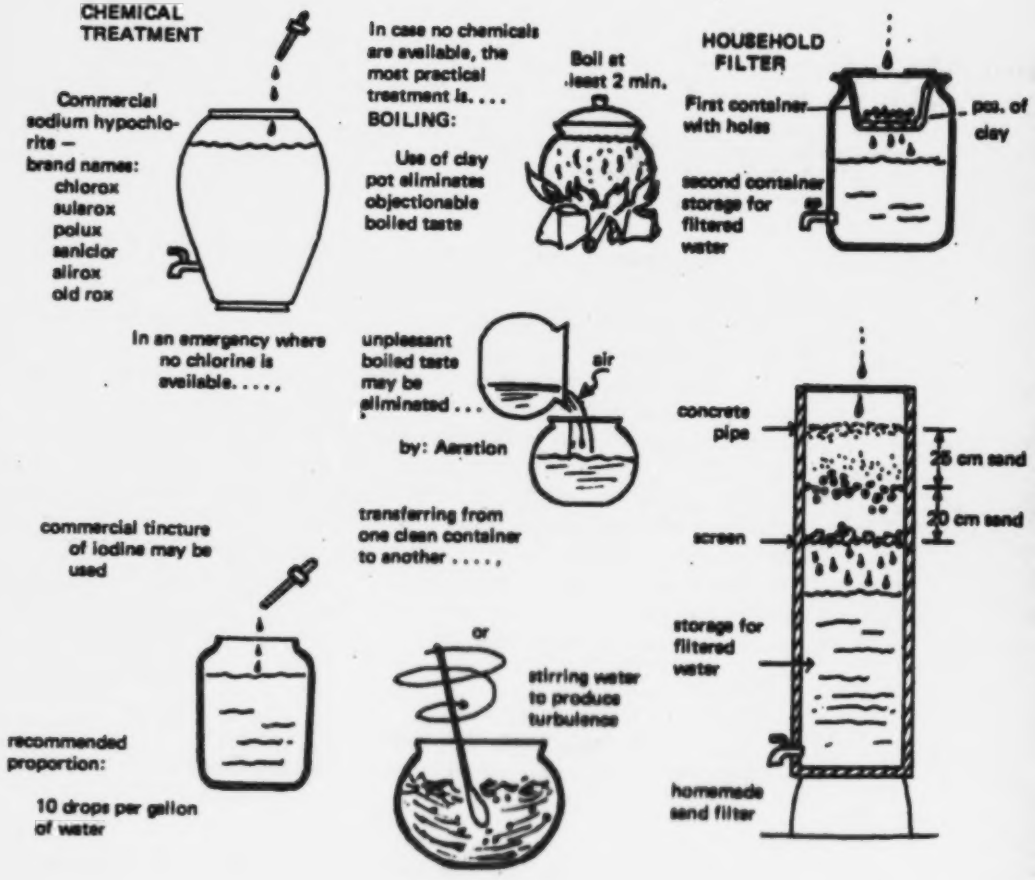
CHEMICAL TREATMENT
Commercial sodium hypochlorite – brand names:
chlorox
sularox
polux
sanicior
alirox
old rox
In an emergency where no chlorine is available. . . . .
commercial tincture of iodine may be used
recommended proportion:
10 drops per gallon of water
In case no chemicals are available, the most practical treatment is. . . .
BOILING:
Use of clay pot eliminates objectionable boiled taste
Boil at least 2 min.
unpleasant boiled taste may be eliminated . . .
by: Aeration
air
transferring from one clean container to another . . . . .
or
stirring water to produce turbulence
HOUSEHOLD FILTER
First container with holes
pcs. of clay
second container storage for filtered water
concrete pipe
25 cm sand
20 cm sand
screen
storage for filtered water
homemade sand filter

Figure 18

Source: Environmental Series, Vol. 1, No. 1 (1978)
Environmental Center of the Philippines, Manila

What can we do to solve our water problems?

What can an individual and his family do to keep sanitary conditions in the neighborhood with no safe water supply piped to the homes? What is the individual's responsibility to himself? to his family? to the neighborhood? What can we do to ensure a continuous and acceptable supply of water?

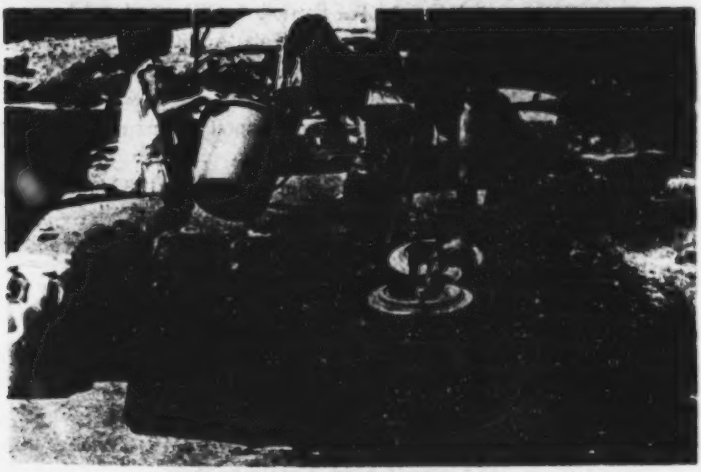

Figure 17. Growing population demands more quality water supply.

We must remember, and remind others, too, that one very good way to ensure a supply of water for domestic and other uses is to keep the water sources clean. This means we must not put garbage and other wastes into streams and other waterways. No one should throw papers, cans, plastics and other trash into any possible source of water. Industries should not be allowed to thoughtlessly dump sewage into streams or rivers.

Trees and other plants serving as land cover must be maintained and conserved. These plants would let water sink into the ground slowly or trickle gently into streams. Our natural water reservoirs would then be maintained.

All these measures, require the cooperation of people, government and private agencies, and industries.

From a general sanitation point of view, permanent improvements in health are unlikely, if not impossible unless a **safe and convenient water supply** accompanies other sanitary measures. Improved fecal disposal, food and market sanitation, personal hygiene and community cleanliness, undertaken to prevent and control diseases, are dependent on the availability of a good water supply.

Therefore an improvement in water supply and sanitation can generate interrelated improvements in health, income and social welfare.

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LIST OF APPENDICES

1. Selected Characteristics of Dwelling Units and Households
2. Water-Related Diseases: Their Entry and Exit in Man
3. Modes by Which Certain Water-borne Diseases are Spread
4. Number of Cases and Death by Leading Diseases
5. Highest Number of Cases for Several Diseases in Various Regions
6. Morbidity Causes/Mortality Causes

ACTIVITIES RELATED TO APPENDICES

With the data presented in these appendices do some or all of the following exercises or answer the questions.

1. Write a short paragraph where your household or the households in your own neighborhood falls as a group in both categories A and B (Appendix 1). Indicate what could be done to keep conditions sanitary and safe for the health of the neighborhood.
2. List the diseases you know personally through yourself or family members by being actually infected at one time. Compare with your classmates'/neighbors' list and make a group list.
3. Name some ways by which the spread of the diseases in Appendix 3 may be stopped.
4. What can you generalize about the state of sanitation in the country based on the data?
5. Study the table that shows the highest incidence of disease (Appendix 4) by region (Appendix 5). Why is the given disease prevalent in a particular region? Would the geographical climate, water source, and economic condition in the region have something to do with it? Support your answer.
6. What can you say about the leading causes of death and morbidity in the country? Can they be prevented? What is the individual's responsibility? (Appendix 6, Tables III & IV).

SUGGESTED GROUP ACTIVITIES

1. Find out from the Local Water Utilities Administration (LWUA) office, if they have data on sources of water in your area. Report this to the class.

   If the data is not available, try to make a survey of sources of water for drinking, washing and other household chores for families in your area. Prepare a report on the results of your survey. You may present this report in class.
2. A study maybe conducted to find out the incidence of water-related diseases in the community. Students may obtain their data from the reported cases at the Rural Health Units or Community Hospitals. The result of this study can be related to the study on water sources.
3. A survey can be done on the health and sanitation aspect of the community. Students can find out how many households have sanitary toilets and water source fit for drinking. Relate the result of this study to the study done by the other groups.

Based on the results of the study, a recommendation can be presented by the whole class. This can be given to the local barangay, the school officials and the health department personnel for study and implementation of programs related to water, diseases, health and sanitation.

Appendix 1. **Selected Characteristics of Dwelling Units and Households, Urban-Rural: May 1980**

Characteristics	Philippines		Urban		Rural	
	No. of households	Percent	No. of households	Percent	No. of households	Percent
A. by type of water supply used	6 163 128	100.00	1 884 291	100.00	4 278 837	100.00
piped water	1 481 040	24.03	1 023 138	54.30	457 902	10.70
artesian well	526 336	8.54	179 759	9.54	346 577	8.10
pump	1 774 985	28.80	477 287	25.33	1 297 598	30.33
open well	1 379 089	22.38	107 931	5.73	1 271 158	29.71
spring	710 968	11.54	36 845	1.96	674 123	15.75
rain water	157 302	2.55	49 822	2.64	107 480	2.51
others	133 408	2.16	9 509	0.50	123 899	2.90
B. by type of toilet facilities						
flush/water sealed	1 392 007	22.59	911 171	48.36	480 836	11.24
Antipolo/ closed pit	679 689	15.90	360 318	19.12	619 371	14.47
open pit	1 413 469	22.93	225 152	11.15	1 188 317	27.77
public toilet	114 386	1.85	63 557	3.37	50 829	1.19
none	2 263 577	36.73	324 093	17.20	1 939 484	45.33

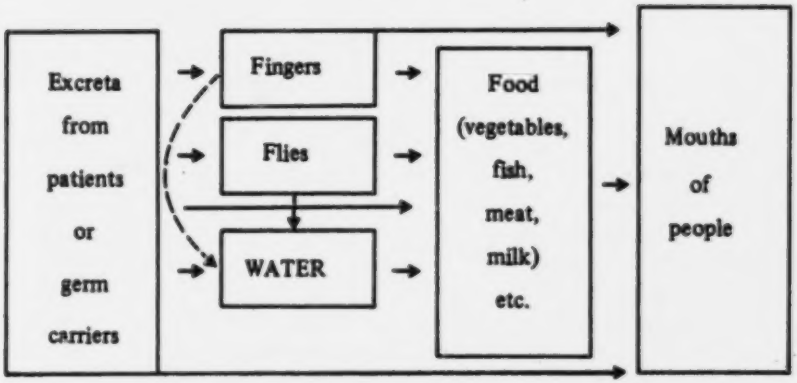
Source: Statistical data are derived from Rural Water Supply Project: Final Report, Volumes I and II; Ministry of Public Works: Bureau of Water Supply, June, 1981.

Appendix 2: **Water-Related Diseases: Their Entry and Exit in Man**

Group	Diseases	Route Entering Man	Route Leaving Man
I	Cholera	oral	feces
	Typhoid	oral	feces, urine
	Amoebiasis	oral	feces
	Infectious hepatitis	oral	feces
II	Scabies	cutaneous	cutaneous
	Skin sepsis	cutaneous	cutaneous
	Yaws	cutaneous	cutaneous
	Leprosy	nose (?)	?
	Lice and typhus	bite	bite
	Trachoma	cutaneous	cutaneous
	Conjunctivitis	cutaneous	cutaneous
	Bacillary dysentery	oral	feces
	Salmonellosis	oral	feces
	Enterovirus diarrhea	oral	feces
	Paratyphoid fever	oral	feces
	Ascariasis	oral	feces
	Trichuriasis	oral	feces
	Whipworm (Enterobius)	oral	feces
III	Schistosomiasis	percutaneous	feces
IV	Hemorrhagic fever	bite (mosquito)	bite
	Bancroftian filariasis	bite (mosquito)	bite
	Malaria	bite (mosquito)	bite
V	Hookworm (Necator)	percutaneous	feces
	Clonorchiasis (liverfluke)	fish	feces
	Diphyllobothriasis (tapeworm)	fish	feces
	Fasciolopsiasis (intestinal fluke)	edible plant	feces
	Paragonimiasis (lung fluke)	crayfish	feces, sputum

Source: Saunders, Robert and Jeremy Warford, *Village Water Supply*. The John Hopkins Univ. Press. Baltimore, 1976.

Appendix 3. Modes by which certain water-borne diseases are spread



Appendix 4. Number of Cases and Deaths by Leading Diseases (1976)

Diseases	Cases	Deaths
Gastroenteritis and colitis	229 579	15 529
Schistosomiasis	51 094	642
Malaria	35 553	997
Dysentery, all forms	22 099	907
Infectious hepatitis	6 815	772
Typhoid, Paratyphoid, Salmonella infection	3 448	688
Cholera El Tor	1 488	413
Food poisoning	860	168
Viral encephalitis	536	407
Filariasis	62	5

Source: Philippine Health Statistics, Disease Intelligence Center, Ministry of Health.

Appendix 5. **Highest Number of Cases for Several Diseases in Various Regions (1976)**

Diseases	Number	Region	Population (× 1 000)
Gastroenteritis	37 600	III	4 385.7
	25 001	IV	5 329.9
Schistosomiasis	2 465	VIII	2 55.4
	963	XI	2 947.1
Malaria	11 699	IV	5 329.9
	7 889	IX	2 308.8
Dysentery	5 667	XI	2 924.1
	2 444	X	2 524.1
Infectious hepatitis	994	NCR	5 243.5
	808	XI	2 947.1

Source: Philippine Health Statistics, Disease Intelligence Center, Ministry of Health.

Appendix 6. **Morbidity Cases from 1972-1976**

	1972		1973		1974		1975		1976	
	Number	Rate[1]	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1. Cholera/El Tor	5 896	15.1	3 130	7.8	2 104	5.1	1 179	2.8	1 445	3.3
2. Typhoid, Paratyphoid & other Salmonella infection	4 495	11.5	4 848	12.1	3 767	9.1	3 101	7.3	3 448	7.9
3. Dysentery, all forms	21 774	55.8	23 935	59.5	23 552	56.8	20 214	47.5	22 099	50.5
4. Food poisoning	933	2.4	1 719	4.3	630	1.5	491	1.2	860	2.0
5. Gastroenteritis and colitis	258 282	661.6	277 108	689.0	245 813	592.9	202 472	476.2	229 579	524.7
6. Viral Encephalitis	216	0.6	256	.6	581	1.4	596	1.4	536	1.2
7. Infectious Hepatitis	4 789	12.3	6 752	16.8	5 977	14.4	4 410	10.4	6 815	15.6
8. Malaria	27 090	69.4	31 999	79.6	27 420	66.1	27 077	63.7	35 553	81.3
9. Schistosomiasis	2 816	7.2	3 094	7.7	3 482	8.2	2 643	6.2	51 094	11.6
10. Filariasis	21	.05	70	0.2	226	.5	30	.07	62	0.1

[1] Rate per 100,000 population

Source: Philippine Health Statistics, Disease Intelligence Center, Ministry of Health.

Population: 1972 = 39 040 100
1973 = 40 219 000
1974 = 41 457 100
1975 = 42 517 300
1976 = 43 751 300

Appendix 7. **Mortality Causes from 1972-1976**

	1972		1973		1974		1975		1976	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1. Cholera/El Tor	703	2.8	787	2.0	347	0.8	290	0.7	413	1.1
2. Typhoid, Paratyphoid & other Salmonella infection	542	1.4	587	1.5	572	1.4	596	1.4	688	1.6
3. Dysentery, all forms	877	2.2	756	1.9	646	1.6	591	1.4	906	2.1
4. Food poisoning	173	0.4	251	0.6	195	0.5	120	0.3	168	0.4
5. Gastroenteritis and colitis	17 167	44.0	18 106	45.0	15 182	36.6	11 818	27.8	15 529	35.5
6. Viral Encephalitis	16	0.04	46	0.1	501	1.2	518	1.2	407	0.9
7. Infectious Hepatitis	398	1.0	548	1.4	635	1.5	649	1.5	772	1.8
8. Malaria	656	1.7	845	2.1	938	2.3	1 018	2.4	997	2.3
9. Schistosomiasis	472	1.2	494	1.2	535	1.3	523	1.2	642	1.5
10. Filariasis	4	0.01	2	0.005	0	–	4	0.009	5	0.01

Source: Philippine Health Statistics, Disease Intelligence Center, Ministry of Health.

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